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ABSTRACT

This report examines the research and development (R&D) funding of U.S. firms in foreign countries, discussing the available statistical data and describing the reasons for and location of foreign R&D programs undertaken by these companies. Expenditures of U.S. firms for R&D performed abroad reached $1.5 billion, increasing 41% from 1974 to 1977, compared to a 32% increase for industrial R&D performed within the U.S. R&D directors gave meeting local market conditions as the most frequent reason for locating or expanding R&D activities in foreign countries. Only an estimated 15% of the major U.S. industrial R&D performers spend any portion of their company funds outside the U.S. (Author/BB)

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*Reviews* OF DATA ON SCIENCE RESOURCES

NATIONAL SCIENCE FOUNDATION, WASHINGTON, D.C. NSF 79-304 No. 33, APRIL 1979

# U.S. Industrial R&D Spending Abroad

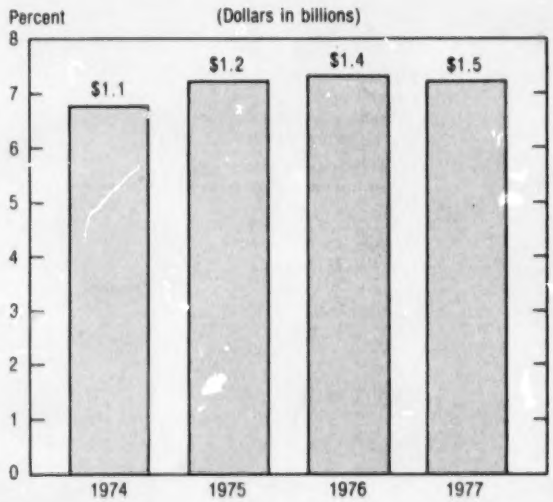
### Assessment Highlights

- Expenditures of U.S. firms for research and development performed abroad reached $1.5 billion, increasing 41 percent from 1974 to 1977, compared to a 32-percent increase for industrial research and development performed within the United States. Research and development in the machinery industry and chemicals and allied products accounted for more than one-half of the foreign increase.
- R&D directors—from firms that spend approximately one-quarter of the industrial R&D funds spent abroad—gave "meeting local market conditions" as the most frequent reason for locating or expanding R&D activities in foreign countries. Government regulations were quoted to be a major cause for moving R&D activities abroad by only one group—firms comprising the drug industry and then only during the initial part of the period surveyed. Differentials in personnel and materials costs were not considered by company officials interviewed to be primary factors in their decision to conduct R&D activities abroad.
- An assessment of even the near-term outlook for the level of R&D spending abroad by U.S. companies is difficult because of the sharp decline in the value of the U.S. dollar relative to foreign currencies. As the dollar falls in value, firms expect an increase in sales to foreign markets. However, firms also find profitability of foreign operations declining. Thus, few officials interviewed were willing to speculate on what future levels of their firm's R&D expenditures abroad might be.

### Data Highlights

- During the 1974-77 period, foreign R&D spending by U.S. firms has remained relatively constant at about 7 percent of their overall company-funded R&D expenditures (chart 1).

**Chart 1.—Percent of company-funded R&D expenditures of U.S. firms spent in foreign countries: 1974-77**




SOURCE: National Science Foundation

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- Three major industry groups account for nearly two-thirds of U.S. company R&D expenditures abroad. The machinery industry is by far the largest in terms of foreign R&D expenditures (28 percent of the U.S. total in 1977), followed by chemicals and allied products (19 percent), and electrical equipment and communication (17 percent).
- Among these industries, chemicals and allied products reported the largest relative foreign increase from 1974 to 1977 (81 percent) compared to a 34-percent increase in company R&D funds spent in the United States. Most of the rise came in the drugs segment of this industry. Machinery ranked second with a 61-percent increase in expenditures abroad compared to a 37-percent increase domestically.
- According to the U.S. Bureau of the Census, only an estimated 15 percent of the major U.S. industrial R&D performers spend any portion of their company funds outside the United States. The Census Bureau estimates, however, that these firms account for nearly one-half of total U.S. company-funded R&D expenditures.

## Introduction

This report examines the R&D funding of U.S. firms in foreign countries, discussing the available statistical data and describing the reasons for and location of foreign R&D programs undertaken by these companies. Prior to the Foundation's collection of data on R&D expenditures abroad by domestic firms, little information was available on these activities. These statistics could not provide any insight into reasons for R&D performance abroad or about possible future trends. Thus, this study was undertaken to provide such information.

**TABLE 1. COMPANY R&D PERFORMED BY FOREIGN AFFILIATES OF U.S. COMPANIES OUTSIDE THE UNITED STATES BY SELECTED INDUSTRY: 1974-77**

**[Dollars in millions]**

| Industry | SIC code | 1974[1] | 1975 | 1976 | 1977 |
|---|---|---|---|---|---|
| Total | - - | $1,064 | $1,211 | $1,377 | $1,499 |
| Food & kindred products | 20 | 18 | 13 | 18 | 19 |
| Chemicals & allied products | 28 | 158 | 215 | 254 | 286 |
| Industrial & other chemicals | 281-82, 284-89 | 82 | 85 | 108 | 130 |
| Drugs & medicines | 283 | 76 | 130 | 146 | 156 |
| Stone, clay, & glass products | 32 | 7 | 7 | (2) | (2) |
| Primary metals | 33 | 3 | 9 | 12 | 11 |
| Fabricated metals | 34 | (2) | (2) | 22 | 25 |
| Machinery | 35 | 258 | 331 | 352 | 416 |
| Electrical equipment & communication | 36,48 | 228 | 232 | 263 | 253 |
| Electronic components | 367 | 4 | 7 | 9 | 9 |
| Other electrical equipment | 361-64,369 | (3) | (3) | 6 | 6 |
| Aircraft & missiles | 372,376 | 9 | 5 | 5 | 6 |
| Professional & scientific instruments | 38 | 39 | 49 | 49 | 54 |
| Other manufacturing industries | 13,20-27, 29-31,371, 373-5,39 | 341 | 346 | 398 | 421 |
| Nonmanufacturing industries | 07-12,14-17, 41-47,49-67, 737,739,807, 891 | 3 | 4 | 4 | 8 |

[1] Based on data obtained from the top 200 U.S. R&D-performing companies.
[2] Included in the other manufacturing industries group.
[3] Not separately available but included in electrical equipment and communication total.

Source: National Science Foundation.

## Recent Trends

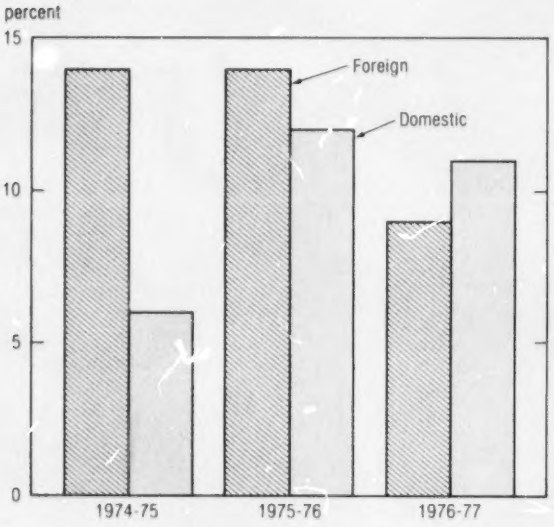
Companies report the U.S. company funds for R&D programs abroad, on an overall basis, are increasing (table 1) but not in relation to company funds for domestic R&D performance. The rate of increase in foreign R&D spending in 1975 was more than twice that of domestic R&D funds (chart 2). Between 1975 and 1977, however, company funds for foreign research and development and domestic R&D expenditure increases were comparable.

The vast majority of U.S. firms do not conduct any research and development abroad. According to the Census Bureau, only an estimated 15 percent of the major U.S. industrial R&D performers maintain foreign laboratories. These firms, however, account for nearly one-half of total U.S. company-funded R&D expenditures. It is highly unusual for smaller U.S. firms to have a foreign R&D facility.

Foreign R&D spending by U.S. firms, as noted above, amounts to about 7 percent of industry's company R&D funds. Among individual industries, however, the ratio varies from under 1 percent in aircraft and missiles to 11 percent and 12 percent, respectively, in the machinery and drugs and medicines industries (table 2). These two industries with the highest ratios have also been the only industries to increase their foreign R&D programs at a significantly faster rate than domestic efforts (chart 3).

Although foreign R&D investment by all U.S. companies grew at an average annual rate of 12

**Chart 2.—Percent increases in foreign and domestic company-funded R&D expenditures of U.S. firms: 1974-77**




SOURCE: National Science Foundation

**TABLE 2. PERCENT OF COMPANY-FUNDED R&D EXPENDITURES OF U.S. FIRMS SPENT IN FOREIGN COUNTRIES BY SELECTED INDUSTRY: 1977**

**[Dollars in millions]**

| Industry | Total company funds | U.S. expended | Foreign expended | Foreign as % of total |
|---|---|---|---|---|
| Total | $20,821 | $19,322 | $1,499 | 7.2% |
| Chemicals & allied products | 3,258 | 2,972 | 286 | 8.8 |
| Industrial & other chemicals | 1,958 | 1,828 | 130 | 6.6 |
| Drugs & medicines | 1,338 | 1,182 | 156 | 11.7 |
| Primary metals | 511 | 500 | 11 | 2.2 |
| Fabricated metals | 364 | 339 | 25 | 6.9 |
| Machinery | 3,807 | 3,391 | 416 | 10.9 |
| Electrical equipment & communication | 3,498 | 3,245 | 253 | 7.2 |
| Aircraft & missiles | 1,584 | 1,578 | 6 | (1) |
| Professional & scientific instruments | 1,302 | 1,248 | 54 | 4.1 |

[1]Less than 1 percent.

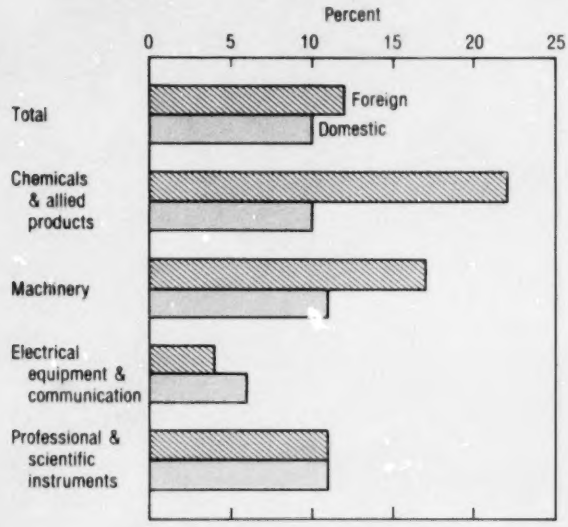
Source: National Science Foundation.

### Note

*Statistical data used in this report were collected by the U.S. Bureau of the Census as part of the annual NSF-sponsored Survey of Research and Development in Industry. In addition, 18 in-depth interviews were conducted with industrial R&D directors, primarily in the five leading R&D-performing industries. The qualitative discussions in this report are based primarily on these interviews and generally reflect conditions as of the middle of 1978. The statistical data cover the years 1974 to 1977.*

*Companies interviewed included Abbott Laboratories, American Home Products, Bausch and Lomb, Colgate-Palmolive, Deere, Eastman Kodak, Gillette, Gulf Oil, ITT, Lever Brothers, Merck, Monsanto, NCR, Pfizer, RCA, Raytheon, Sperry Rand, and Westinghouse. Based on Census Bureau statistics, it is estimated that these 18 firms accounted for over one-quarter of industrial R&D spending abroad.*

**Chart 3.—Average annual change in company-funded foreign and domestic R&D expenditures by selected industry: 1974-77**




SOURCE: National Science Foundation

percent between 1974 and 1977, the chemicals industry, including drugs, rose at a 22-percent annual rate and the machinery industry went up 17 percent annually. These two industries were affected by special factors. A large R&D performer in the machinery industry acquired a new foreign R&D facility during this period. Further, the machinery industry includes computer manufacturers whose products typically need to be more specifically tailored to customers' needs. Although computer companies only account for about one-quarter of total domestic machinery industry sales, these firms perform over two-thirds of the industry's research and development.

The drugs and medicines segment was primarily responsible for the chemical industry's above-average foreign R&D growth. Drug companies increased their R&D spending abroad by an average annual rate of 27 percent between 1974 and 1977, from $76 million to $156 million. In contrast, their domestic company R&D expenditures increased at an annual rate of only 7 percent during this period reaching a total of $1.1 billion in 1977. However, essentially all of the overseas R&D increase was confined to 1975. The rapid increase was attributed by officials of the companies to new Food and Drug Administration (FDA) requirements adopted in 1975 that liberalized the policy regarding foreign testing. The adoption of this regulation encouraged some drug companies to increase foreign research and development significantly in 1975. Since that time, domestic and foreign R&D growth has been about the same.

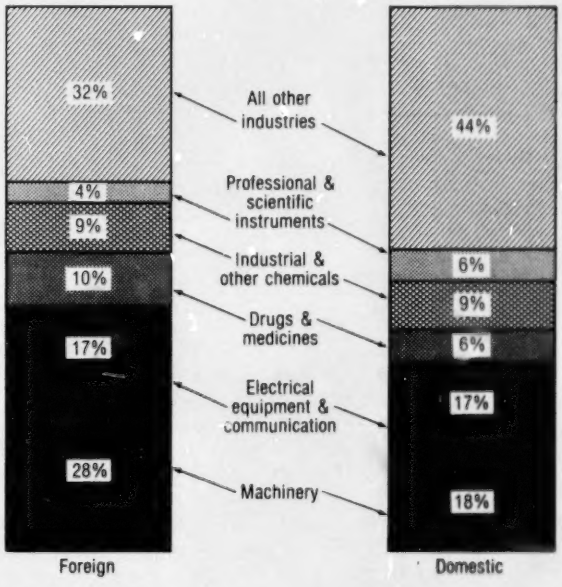
Industries which are the largest performers of domestic research and development are also generally the leading performers of research and development abroad (chart 4). The major exception to the above is the aircraft and missiles industry, whose R&D programs are heavily oriented toward defense needs.[1]

### Reasons for Maintaining Foreign R&D Programs

A variety of reasons were advanced to explain the existence of separate overseas facilities. Most interviewed company officials were in agreement that the major reason for maintaining an R&D facility in another country was to adapt products to

[1] Because of relatively low R&D spending levels in overseas laboratories, and/or a concentration of expenditures by only a few firms, the Census Bureau has not been able to provide separate data for some industries. These industries are combined in table 1 and are termed "Other manufacturing." One interviewee stated that the petroleum industry probably accounted for a significant portion of this "Other manufacturing" total. R.R. Bowker Company, *Industrial Research Laboratories of the United States, 1977* (New York, 1977) tended to verify this comment.

**Chart 4.—Concentration of company-funded foreign and domestic R&D expenditures by major performing industry: 1977**




SOURCE: National Science Foundation

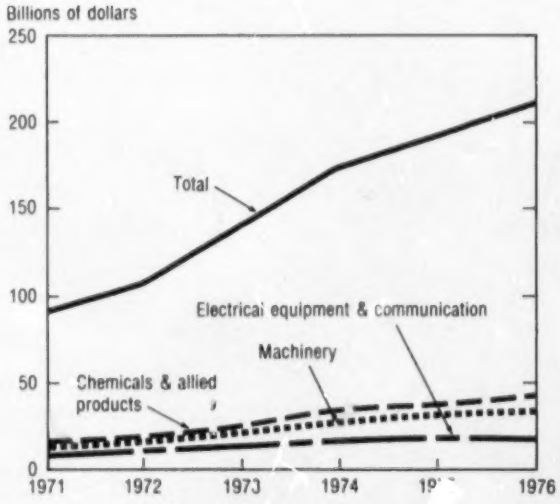
local market conditions. Clearly, there are sharp differences in the markets that U.S. firms serve. These differences exist not only from place to place within the United States, but are even greater among countries. For example, chemical companies develop different mixtures of fertilizers to serve various geographic areas within the United States. Sharper climates, soils, and related differences of markets served in other countries require additional modification. In the view of company R&D officials, these modifications can best be accomplished as close to the ultimate market as possible. Thus, the major thrust of foreign efforts is in the development part of "R&D." Another factor is the periodic necessity to develop alternate product compositions as a result of shortages or much higher prices for specific raw materials.

Another important reason cited for establishing overseas R&D facilities is expansion abroad by U.S. firms. According to Federal Trade Commission data, domestic sales of U.S. manufacturing firms rose at an 8-percent annual rate between 1974 and 1977.[2] In contrast, the Department of Commerce data show that sales by foreign affiliates of U.S. manufacturing firms rose at an average annual rate of 10 percent between 1974 and 1976 (1977 data are not available at this time).[3] Additionally, sales by foreign affiliates during the 5-year period 1971-76 rose dramatically (chart 5). As decisions by corporations to expand are generally made on the basis of longer term trends, this chart shows sales data for several years prior to the R&D data presented in this report.

According to the interviewed officials, the sales increases overseas have led to more research and development performed abroad, primarily to adapt products to local market conditions. For the major industries with foreign R&D laboratories, their increases in R&D spending have been in concert with overseas sales gains during the past few years.

Government regulations were cited, especially by drug industry representatives, as a further reason for maintaining facilities abroad. According to industry spokesmen, until 1975 the drug industry faced strict and extensive premarket testing requirements in the United States. By being nondefinitive regarding the acceptance of testing

**Chart 5.—Sales by majority-owned[1] foreign affiliates of U.S. manufacturing companies by major industry: 1971-76**




[1]50 percent or greater.
SOURCE: U.S. Department of Commerce

done in foreign countries, these FDA requirements often resulted in longer lead times between the conception of a new drug and its ultimate approval for marketing.

However, in April 1975 the FDA issued a new Foreign Clinical Studies Regulation, 21 CFR 313.20, which defined more specifically the agency policy for accepting test results from foreign markets. The regulation was first proposed in 1973.

Allegedly, this new policy caused some drug manufacturers to establish or expand R&D facilities in foreign countries. This push to expand abroad, following the liberalization of FDA rules, caused foreign R&D expenditures by the drug industry to grow at an accelerated pace between 1974 and 1975.

Since that time, however, the growth of foreign R&D expenditures by drug companies has moderated, approximating the domestic R&D growth trend in this industry, leading industry officials interviewed for this study to expect a continuation of this trend.

Discussions with FDA personnel tend to confirm the comments from industry, noting that the acceptance and successful use of a drug in other countries has been helpful in specific instances in gaining faster approval for U.S. marketing. A

[2] Federal Trade Commission, *Quarterly Report of Manufacturing, Mining, and Trade Corporations* (Washington, D.C.).

[3] Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business* (Washington, D.C.).

number of other actions have been taken by the FDA to try to reduce the time involved for clearance; e.g., drugs with especially high potential have been given a higher priority.

Companies outside of the drug industry also commented that government regulation played a role in increasing their dependence on foreign laboratories. Specifically mentioned were Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) regulations, but these concerns were relatively minor when compared to the drug industry situation.

A further reason for having R&D facilities abroad was thought to be the advantage of somewhat lower costs. For example, a survey by the Conference Board found that 1972 salaries paid both R&D scientists and engineers and R&D supporting personnel were significantly higher in U.S. parent companies than in their foreign affiliates.[4] Since that time, most European countries, as well as Canada and Japan, have experienced a sharper rise in worker compensation than the United States.[5] Although specific data are not available, there seems to be no reason to suspect that the wage situation is significantly different for R&D personnel. As of 1978, all companies interviewed noted that competent foreign national R&D personnel cost about the same or are more expensive than comparable U.S. personnel.

Among the other reasons advanced for performing research and development abroad were acquisition of a foreign subsidiary with an existing R&D capability and establishment of a laboratory because a special technical expertise was available.

**Laboratory Locations**

Representatives from the 18 companies interviewed stated that Western Europe, Canada, and Japan were the principal locations of their overseas R&D laboratories.[6] High-technology industries, such as electrical equipment, tend to concentrate their foreign R&D programs in Europe and Japan where an ample supply of qualified scientific and technical personnel are available. Consumer-oriented companies, such as manufacturers of household chemical-based products, generally have development laboratories in several locations because their sales are spread over a wide area and the products manufactured by these firms must conform to a wide variety of tastes or market needs. For example, the formulation of automotive fuel necessarily must be substantially modified for use in different parts of the world.

Other factors cited as affecting the placement of foreign R&D laboratories are availability of English-speaking personnel; proximity to manufacturing plants; and, promotion of goodwill between the company and a particular government. The last is important for beneficial licensing and pricing arrangements in countries with controlled economies, and may facilitate product introduction into such countries.

**The Role of the Foreign Laboratory Within the Firm**

Companies that place substantial corporate-wide reliance on research and development, such as those in the electrical equipment industry, typically include their foreign laboratories as part of an overall corporate R&D function. This encourages a more systematic and integrated approach to research and development and also facilitates scientific communication among the R&D professionals. In contrast, companies in industries with less emphasis on research and development, such as the food industry, are more likely to assign their laboratories to specific operating or marketing divisions in order to obtain information about local buyers' tastes and/or market needs. For both types of companies, the U.S. laboratory generally takes the lead in overall technological development, with the foreign laboratories providing specialized development for particular market conditions.

Although research (both basic and applied) accounts for almost one-quarter of total domestic R&D spending by U.S. firms, their foreign R&D facilities primarily conduct development projects. More specifically, only one company interviewed reported any basic research expenditures abroad. Two others noted that their foreign facilities did some applied research work.

In discussing the organizational structure of their foreign R&D laboratories, company officials were in agreement that, whenever possible, practically

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[4] Daniel Creamer, Anthony D. Apostolides, and Selina L. Wang, *Overseas Research and Development by United States Multinationals, 1966-1975*, Research Report from the Conference Board's Division of Economic Research (New York: The Conference Board, 1976), p. 72.

[5] Executive Office of the President, *Economic Report of the President*. Transmitted to the Congress, January 1978 (Washington, D.C. 20402: Supt. of Documents, U.S. Government Printing Office), p. 72.

[6] Western European nations favored were the United Kingdom and Switzerland, in large part because of the high degree of technical expertise located in these countries. Non-European locations cited were Brazil, Australia, the Philippines, and South Africa.

all of the staffing came from local foreign nationals. The relocation and maintenance costs of assigning U.S. nationals to an overseas facility are high, generally precluding their employment to any appreciable extent.

**Outlook**

As a result of the mid-1978 economic situation caused by the declining value of the U.S. dollar, the outlook for increased research and development abroad by U.S. companies is unclear. Some of those interviewed expressed concern at the rising costs being encountered abroad because of this unfavorable exchange rate, indicating that this factor might cause a slowdown in the growth of their foreign R&D operations.

On the other hand, companies generally employ much the same rationale for R&D investment abroad as they do for domestic R&D spending—it is largely a function of sales. It is expected that the foreign sales of U.S. corporations will continue to increase, spurred on by a continuing demand for American goods, and, at least in the short run, exchange rates favorable to customers abroad. Thus, increased sales and potential overseas demand may cause U.S. companies to open new foreign R&D laboratories or expand existing operations. Many of the interviewees indicated that foreign R&D expansion would be dependent on continued sales and the corporation's desire to expand into new areas. They indicated that other factors, such as lower R&D costs, would not be the prime motivation for new or expanded laboratories.

Several R&D directors outside of the pharmaceutical industry noted the generally increased regulatory climate in the United States—particularly the OSHA and EPA regulations—and suggested that the increased requirements would tend to cause companies to move R&D resources to other countries where operations would not be affected as much by these regulations. Others interviewed stated that company policy required uniform safety and antipollution standards at all locations, and thus no movement of resources was anticipated.

Some drug industry personnel predicted that newly proposed legislation, which would lessen the strengency of current FDA premarket testing requirements, would have a stabilizing effect on the growth of R&D expenditures abroad in that industry. On the other hand, the worldwide push for better health care, especially in less developed countries, probably will induce this industry to set up new R&D laboratories in those places to investigate indigenous health problems. Although these factors should tend to offset each other, it is anticipated that the new market potential will ultimately be more significant.

Machinery industry foreign sales, especially for computers and farm equipment, are expected to continue to increase, thus creating further need for development abroad. Electrical equipment industry spokesmen predict a stabilization in their foreign R&D effort, primarily as a result of market maturity. R&D expenditures abroad in the instruments industry are expected to expand at about the same pace as domestic research and development in that industry. In the chemicals industry, new foreign markets for pesticides, fertilizers, and synthetic fibers will probably cause R&D laboratories to grow at an above-average pace.



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